

What is claimed is:

1. A method of plasma etching a layer of dielectric material having a dielectric constant that is greater than 4 comprising the steps of:

 exposing said dielectric material layer to a plasma comprising a reducing gas and a halogen containing gas.

2. The method of claim 1 wherein the dielectric material is at least one of HfO_2 , ZrO_2 , Al_2O_3 , BST, PZK, ZrSiO_2 , HfSiO_2 , and TaO_2 .

3. The method of claim 1 wherein the dielectric material is HfO_2 .

4. The method of claim 1 wherein the halogen containing gas comprises a chlorine containing gas.

5. The method of claim 1 wherein the reducing gas comprises carbon monoxide.

6. The method of claim 1 wherein halogen gas comprises chlorine and the reducing gas comprises carbon monoxide.

7. The method of claim 4 wherein said chlorine containing gas is Cl_2 .

8. The method of claim 6 wherein said exposing step further comprises the step of:

 supplying 20 to 300 sccm of Cl_2 and 2 to 200 sccm of CO.

9. The method of claim 1 further comprising the step of:
 maintaining a gas pressure of between 2-100 mTorr.

10. The method of claim 6 further comprising the step of:
 maintaining a gas pressure of 4 mTorr.

11. The method of claim 1 further comprising the step of:
 applying a bias power to a cathode electrode of 5 to

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100 W.

12. The method of claim 6 further comprising the step of:
applying a bias power to a cathode electrode of 20 W.
13. The method of claim 1 further comprising the step of:
applying an inductive source power to an inductively
coupled antenna of 200 to 2500 W.
14. The method of claim 6 further comprising the step of:
applying an inductive source power to an inductively
coupled antenna of 1100 W.
15. The method of claim 1 further comprising the step of:
maintaining a workpiece containing said hafnium-oxide
layer at a temperature between 100 to 500 degrees Celsius.
16. The method of claim 6 further comprising the step of:
maintaining a workpiece containing said hafnium-oxide
layer at a temperature of 350 degrees Celsius.
17. A method for plasma etching a workpiece having a layer
of hafnium-oxide comprising the steps of:
supplying between 20 to 300 sccm of chlorine and
between 2 to 200 sccm of carbon monoxide;
maintaining a gas pressure of between 2-100 mTorr;
applying a bias power to a cathode electrode of between
5 to 100 W;
applying power to an inductively coupled antenna of
between 200 to 2500 W to produce a plasma containing said
chlorine gas and said sulfur dioxide gas;
maintaining said workpiece at a temperature between 100
and 500 degrees Celsius.
18. A computer-readable medium containing software that when
executed by a computer causes an etch reactor to plasma etch
a layer of dielectric material having a dielectric constant
that is greater than 4 using a method comprising:

exposing said dielectric material layer to a plasma comprising a reducing gas and a halogen containing gas.

19. A computer-readable medium of claim 18 wherein the dielectric material is at least one of HfO_2 , ZrO_2 , Al_2O_3 , BST, PZK, ZrSiO_2 , HfSiO_2 , and TaO_2

20. A computer-readable medium of claim 18 wherein the dielectric material is HfO_2 .

21. A computer-readable medium of claim 18 wherein the halogen containing gas comprises a chlorine containing gas.

22. A computer-readable medium of claim 18 wherein the reducing gas comprises carbon monoxide.

23. A computer-readable medium of claim 18 wherein halogen gas comprises chlorine and the reducing gas comprises carbon monoxide.

27. A computer-readable medium of claim 21 wherein said chlorine containing gas is Cl_2 .

25. A computer-readable medium of claim 23 wherein said exposing step further comprises the step of:
supplying 20 to 300 sccm of Cl_2 and 2 to 200 sccm of CO.

26. A computer-readable medium of claim 18 further comprising the step of:
maintaining a gas pressure of between 2-100 mTorr.

27. A computer-readable medium of claim 23 further comprising the step of:
maintaining a gas pressure of 4 mTorr.

28. A computer-readable medium of claim 18 further comprising the step of:
applying a bias power to a cathode electrode of 5 to 100 W.

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29. The method of claim 23 further comprising the step of:
applying a bias power to a cathode electrode of 20 W.

30. A computer-readable medium of claim 18 further comprising the step of:

applying an inductive source power to an inductively coupled antenna of 200 to 2500 W.

31. A computer-readable medium of claim 23 further comprising the step of:

applying an inductive source power to an inductively coupled antenna of 1100 W.

32. A computer-readable medium of claim 18 further comprising the step of:

maintaining a workpiece containing said hafnium-oxide layer at a temperature between 100 to 500 degrees Celsius.

33. A computer-readable medium of claim 23 further comprising the step of:

maintaining a workpiece containing said hafnium-oxide layer at a temperature of 350 degrees Celsius.

34. A computer-readable medium containing software that when executed by a computer causes a etch reactor to plasma etch a workpiece having a layer of hafnium-oxide using a method comprising:

supplying between 20 to 300 sccm of chlorine and between 2 to 200 sccm of carbon monoxide;

maintaining a gas pressure of between 2-100 mTorr;

applying a bias power to a cathode electrode of between 5 to 100 W;

applying power to an inductively coupled antenna of between 200 to 2500 W to produce a plasma containing said chlorine gas and said sulfur dioxide gas;

maintaining said workpiece at a temperature between 100 and 500 degrees Celsius.

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